Key points

- This study shows that the SRH worsens with age until the age of 49 years, whereas among $\geq$50-year-old the older report better SRH than the younger (the direction of the association reverses in the older age group).
- This research has also found that the influence of lifestyle on the SRH varies across age groups. In younger sub-populations obesity, smoking and non-alcohol are associated with worse SRH, whereas in $\geq$50-year-olds, physical exercise in leisure time and sleeping enough hours improves the SRH.

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International differences in self-reported health measures in 33 major metropolitan areas in Europe

Linsay Gray[1], Juan Merlo[2], Jennifer Mindell[3], Johan Hallqvist[4,5], Jean Tafforeau[6], Dermot O'Reilly[7], Enrique Regidor[8], Øyvind Næss[9], Cecily Kelleher[10], Satu Helakorpi[11], Cornelia Lange[12], Alastair H. Leyland[1]

1 MRC/CSO Social and Public Health Sciences Unit, Glasgow, UK
2 Faculty of Medicine, Lund University, Malmö, Sweden
3 Department of Epidemiology and Public Health, University College London (UCL), UK
4 Public Health Science, Karolinska Institutet, Stockholm
5 Department of Public Health and Caring Sciences,University of Uppsala, Uppsala, Sweden
6 Epidemiology, Scientific Institute of Public Health, Brussels, Belgium
7 Centre for Public Health, Queen's University Belfast, Northern Ireland
8 Department of Preventive Medicine and Public Health, Faculty of Medicine, Complutense University of Madrid, Spain
9 Norwegian Institute of Public Health and Institute of General Medicine and Community Health, University of Oslo, Norway
10 School of Public Health and Population Science, University College Dublin, Republic of Ireland
11 Department of Lifestyle and Participation, National Institute for Health and Welfare (THL), Helsinki, Finland
12 Department for Health Reporting and Epidemiology, Robert Koch-Institut, Berlin, Germany

Correspondence: Dr Linsay Gray, MRC/CSO Social and Public Health Sciences Unit, 4 Lilybank Gardens, Glasgow G12 8RZ, UK, tel: +44 141 357 7540, fax: +44 141 337 2389, e-mail: l.gray@sphsu.mrc.ac.uk

Background: The increasing concentration of populations into large conurbations in recent decades has not been matched by international health assessments, which remain largely focused at the country level. We aimed to demonstrate the use of routine survey data to compare the health of large metropolitan centres across Europe and determine the extent to which differences are due to socio-economic factors. **Methods:** Multilevel modelling of health survey data on 126 853 individuals from 33 metropolitan areas in the UK, Republic of Ireland, Sweden, Norway, Finland, Spain, Belgium and Germany compared general health, longstanding illness, acute sickness, psychological distress and obesity with the average for all areas, accounting for education and social class. **Results:** We found some areas (Greater Glasgow; Greater Manchester, Cheshire and Merseyside; Northumberland, Tyne and Wear and South Yorkshire) had significantly higher levels of poor health. Other areas (West Flanders and Antwerp) had better than average health. Differences in individual socio-economic circumstances did not explain findings. With a few exceptions, acute sickness levels did not vary. **Conclusion:** Health tended to be worse in metropolitan areas in the north and west of the UK and the central belt and south east of Germany, and more favourable in Sweden and north west Belgium, even accounting for socio-economic composition of local populations. This study demonstrated that combining national health survey data covering different areas is viable but not without technical difficulties. Future comparisons between European regions should be made using standardized sampling, recruitment and data collection protocols, allowing proper monitoring of health inequalities.

Introduction

It is known that population health varies across countries and continents. International comparisons provide external standards, help identify important determinants[1] and inform frameworks for setting and monitoring public health goals. The European Commission aims to establish a broad cross-policy framework to respond to a wide range of health challenges,[2] prompting a common initiative. In recent decades there has been an unprecedented concentration of populations into large conurbations and while metropolitan areas in Europe share many features such as high population density, environment and structural organization, their health may vary. Comparisons at this level could help us to understand local features in an international context, providing evidence for health promotion, prioritization and accountability at the local level.[3]

Apart from some studies which have generally had specific foci,[4–7] most international assessments performed to date have been done on an ecological basis[8,9] and have not been based on individual record data using harmonized methodologies. A few recent individual-based studies have made comparisons across European countries but only at national level.[10–11] With few exceptions,[12–13] studies with international coverage[14–16] tend not to have big enough samples to permit comparisons at the sub-country level. There are several ongoing population-based health surveys covering metropolitan areas in Europe that share common design features, providing the opportunity to combine and compare data at this level. However, the validity of available data and practicalities for such comparisons have not been considered.

While international differences in health outcomes may suggest the existence of contextual determinants (such as distinct historical, societal and health care systems), it is possible they could be explained by variations in individual area composition in terms of socio-economic characteristics. To address this issue, we used the internationally harmonious measures of education and occupation-based social class.[17–19]

This aims of this study were to demonstrate the use of routine health survey data for comparing health outcome measures across 33 Europe metropolitan areas, and investigate the extent to which socio-economic circumstances might explain any differences. By combining data on almost 127 000 adults from individual surveys, our collaboration represents the step prior to the creation of a common European public health survey.[20]

Methods

Population health survey data

Analyses were based on data from 12 European health surveys in 11 countries covering Western, Northern and Southern Europe (table 1). These surveys were conducted during 2001–05, and responses ranged from 46% to 85%; the health data at the lower range of response level has been shown to be unbiased in terms of social inequality.[21] Surveys interviews were conducted in person with the exceptions of Germany (telephone), the Republic of Ireland, Sweden and Finland (postal) and Wales (brief face-to-face interview with self-completion questionnaires). European capital cities and greater metropolitan areas with populations of more than 1 000 000[22]—or the closest proxy to these—were identified, with 33 such areas included.

Classification of variables

Measures of highest educational qualification attained were categorized into (i) none, (ii) below degree level, (iii) degree level or above (reference category) and (iv) unclassifiable (Supplementary table 1), broadly corresponding with level 1 (elementary education), levels 2 and 3 (lower and upper secondary education) and levels 4–6 (post-secondary education) of the International Standard Classification of Education.[17] Occupation-based social class was categorised into (i) semi-skilled manual/unskilled manual, (ii) skilled non-manual/skilled manual, (iii) equivalent to professional/managerial (reference category) and (iv) unclassifiable (including missing/insufficient information e.g., retired) (Supplementary table 1).

The following health outcomes were examined: self-rated health; long standing illness; acute sickness; psychological distress and obesity. Participants were asked to rate their own health in general, whether they had any longstanding illness, disability or infirmity and whether they had experienced any illness or injury during the 2 weeks prior to the interview (Supplementary table 2). Psychological distress was measured by the widely used General Health Questionnaire 12 (GHQ-12) protocol on recent concentration, sleeping patterns, self-esteem and depression.[23] Although the GHQ-12 does not enable clinical diagnosis-specific psychiatric diseases, it is used to investigate impaired psychological health in the population,[24] with scores of three or more indicating possible 'caseness' referred to herein as psychological distress.

Body mass index (BMI) was derived from height and weight (directly measured in Scotland, England, Northern Ireland and Norway, and self reported elsewhere). Individuals with directly quantified measurements indicating BMI of 30 kg/m^2 or more were considered obese, while participants in surveys collecting self-reported measurements were classified according to the more conservative cut-off of 29.2 kg/m^2, shown to offer the optimal threshold.[25]

Statistical methods

Logistic regression models were fitted within a multilevel framework[26] with individuals nested within geographical areas. Area residual plots show a measure (on the log odds ratio scale) of the difference between each area and the overall European average (equivalent to a residual value of 0) and they enable comparisons across the areas. First, the prevalence of each health measure was modelled adjusting for age to account for differential age ranges in the surveys (table 2). Then analysis incorporated additional adjustment by social class and education to assess the effect of socio-economic factors on the relationship between area and health measures. Comparing residual values and confidence intervals before and after adjustment allows assessment of the degree of socio-economic confounding. To avoid potential bias, multiple imputation was used to deal with missing data items using Rubin's method.[27] Models were stratified by sex since both biological factors and social constructs

Table 1 European metropolitan areas and corresponding source survey data

Metropolitan area	Survey area	Population (1000s)[a]	Men (56 853)	Women (69 080)
Greater Glasgow	Greater Glasgow[b,c]	1200	557	710
Edinburgh	Lothian[c]	800	473	605
Greater London	North West/North Central/North East/South East/South West London[d]	7429	1763	2292
Manchester-Liverpool	Greater Manchester, Cheshire and Merseyside[d]	2539	1357	1742
West Midlands	Birmingham and the Black Country, West Midlands South[d]	3834	1005	1356
West Yorkshire	West Yorkshire[d]	2108	580	778
Tyne and Wear	Northumberland, Tyne and Wear[d]	1396	447	625
Nottingham	Trent[d]	2687	387	448
South Yorkshire	South Yorkshire[d]	1278	485	608
Portsmouth-Southampton	Hampshire and Isle of Wight[d]	1801	843	1095
Belfast	Eastern Northern Ireland[e]	1139	1887	2373
Cardiff	Cardiff[f]	318	1012	1210
Dublin	Dublin[g]	1187	525	974
Malmö-Copenhagen	Scania[h]	283	12 237[i]	14 806[i]
Stockholm	Stockholm[j]	1975	14 112	17 008
Oslo	Oslo[k]	573	8412	10 373
Helsinki	Uusimaa and Itä-Uusimaa[l]	1484	399	498
Brussels	Brussels[m]	1081	2573	3061
Lille-Kortrijk	West Flanders[n,o]	1130	630	654
Antwerp	Antwerp[n]	1683	1054	1127
Madrid	Madrid[p]	6252	946	1052
Barcelona	Barcelona[p]	5330	755	783
Valencia	Valencia[p]	2268	420	451
Seville	Seville[p]	1759	232	263
Bilbao	Biscay[p]	1330	349	362
Rhine-Ruhr, Aachen, Liège, Maastricht, Bielefeld	North Rhein Westfalia[q]	18 075	836	932
Berlin	Berlin[q]	3400	173	217
Hamburg	Hamburg[q]	1735	73	126
Frankfurt Rhine Main Area, Half of Rhine Neckar Area	Hesse, Rhineland-Palatinate[q]	12 444	518	576
Stuttgart, Half of Rhine Neckar Area	Baden-Württemberg[q]	10 717	478	575
Munich, Nuremberg	Bavaria[q]	12 444	638	628
Halle-Leipzig, Chemnitz-wickau, Dresden	Saxony, Saxony Anhalt[q]	6583	272	334
Bremen, Hanover	Bremen, Lower Saxony[q]	8664	425	438

a: Current total population estimates
b: Preceded the creation of NHS Greater Glasgow and Clyde from the split of NHS Argyll and Clyde in 2006
c: Health board in the Scottish Health Survey 2003 (response 67%)
d: Strategic health authority in the Health Survey for England 2002 (75%), 2003 (73%) and 2004 (72)
e: Health and social services board in the Northern Ireland Health and Wellbeing Survey 2001 (68%) and 2005 (66%)
f: Unitary authority in the Welsh Health Survey 2003 (74%) and 2004 (74%)
g: County (Republic of Ireland) in the Survey on Lifestyle and Nutrition 2002 (53%)
h: County (Sweden) in the Health Survey for Scania 2004 (58%)
i: Sex unknown thus imputed for 920 Scania individuals
j: County (Sweden) in the Stockholm Public Health Survey 2002 (63%)
k: County (Norway) in The Oslo Health Study 2001 (46%)
l: Region in Health Behaviour among the Finnish Adult Population Survey 2003 (67%)
m: Brussels-Capital Region in the Health Interview Survey Belgium 2004 (61%)
n: Province in the Health Interview Survey Belgium 2004 (61%)
o: The Lille-Kortrijk region spans France as well as Belgium; as the area covering Kortrijk, West Flanders is used as a proxy for the entire region
p: Province in the Spanish Health National Survey 2001 (85%)
q: State in the German Telephone Health Survey 2003 (60%)

conditioned by gender may modify expression of health outcomes. Analyses were performed in MLwiN 2.02 and SAS 9.1.

Results

Data were available on 56 853 men, 69 080 women and 920 individuals for whom sex had not been recorded (table 1), average age 48.0 years (table 2). The mean number of records per area was 3844, ranging from 199 in Hamburg to 31 120 in Stockholm (table 1). Of the entire sample with available data, 20% had no formal qualifications, 42% were educated to below degree level and 39% had degree level or above qualifications (table 2). The overall breakdown by social class was 20% semi- or unskilled; 42% skilled occupations and 39% professional/managerial. However, distributions varied greatly across regions. The percentage with degree or above ranged from 9% in Antwerp to 46% in Southern Finland; professional/managerial from 11% in Biscay to 55% in Dublin.

Overall, 6% of men and 7% of women self-reported bad/very bad general health and this was highest among men and women in Greater Glasgow, and lowest among men in Antwerp and West Flanders and women in Antwerp. Longstanding illness prevalences were 32% for men and 34% for women overall and were most common in Hampshire and Isle of Wight and least common in West Flanders.

Table 2 Distribution of socio-demographics European regional area (%)

Area	Age mean (range)	Education				Social class			
Degree or above	Below degree	No qualifications	Unknown	Professional/ Managerial/ technical	Skilled	Semi-skilled/ unskilled	Unknown		
Greater Glasgow	48.4 (16–94)	21	36	43	1	30	42	27	6
Lothian	48.4 (16–90)	30	40	30	1	40	41	19	4
London	42.0 (16–98)	24	54	22	1	42	42	16	2
Greater Manchester, Cheshire and Merseyside	45.4 (16–97)	13	62	25	0	34	46	20	1
Birmingham and the Black Country, West Midlands South	45.8 (1–94)	14	58	28	0	35	42	23	1
West Yorkshire	43.4 (16–99)	13	63	24	1	35	45	20	2
Northumberland, Tyne and Wear	46.5 (16–92)	12	58	30	0	32	42	26	1
Trent	45.3 (16–95)	11	62	27	0	29	48	23	0
South Yorkshire	47.5 (16–96)	16	63	20	0	43	39	18	2
Hampshire and Isle of Wight	46.6 (16–93)	11	62	26	0	34	44	22	1
Eastern Northern Ireland[a]	46.9 (16–95)	16	67	17	24	44	23	33	40
Cardiff	46.6 (16–75+)	25	50	25	7	44	18	38	9
Dublin	46.9 (16–97)	29	37	34	9	55	33	13	0
Scania	48.6 (18–81)	36	24	40	10	40	38	23	41
Stockholm	47.9 (18–84)	36	30	34	0	48	30	22	7
Oslo	51.1 (31–77)	41	21	38	5	30	62	8	31
Southern Finland[b]	41.2 (16–64)	46	41	13	2	–	–	–	–
Brussels	49.4 (16–102)	11	66	23	16	34	44	22	21
West Flanders	49.5 (16–98)	23	57	20	9	47	38	16	11
Antwerp	49.9 (16–103)	9	69	23	13	30	50	19	14
Madrid[c]	45.2 (16–90+)	12	65	23	1	34	45	22	21
Barcelona[c]	45.0 (16–90+)	20	51	29	0	21	50	29	14
Valencia[c]	44.9 (16–90+)	14	56	30	0	16	52	31	17
Seville[c]	43.3 (16–90+)	14	48	38	0	18	46	36	25
Biscay[c]	46.0 (16–90+)	10	48	42	1	11	43	45	26
North Rhein Westfalia[d]	47.1 (18–95)	–	–	–	–	23	48	29	14
Berlin[d]	47.0 (18–91)	–	–	–	–	27	63	9	15
Hamburg[d]	45.8 (18–89)	–	–	–	–	24	69	7	11
Hesse, Rhineland-Palatinate[d]	45.8 (18–85)	–	–	–	–	27	68	5	12
Baden-Württemberg[d]	45.7 (18–89)	–	–	–	–	26	66	8	13
Bavaria[d]	45.6 (18–90)	–	–	–	–	22	67	10	11
Saxony, Saxony Anhalt[d]	49.6 (18–89)	–	–	–	–	24	68	8	11
Bremen, Lower Saxony[d]	45.9 (18–91)	–	–	–	–	15	76	8	13
Total	48.0 (16–90+)	39	42	20	4	39	42	20	12

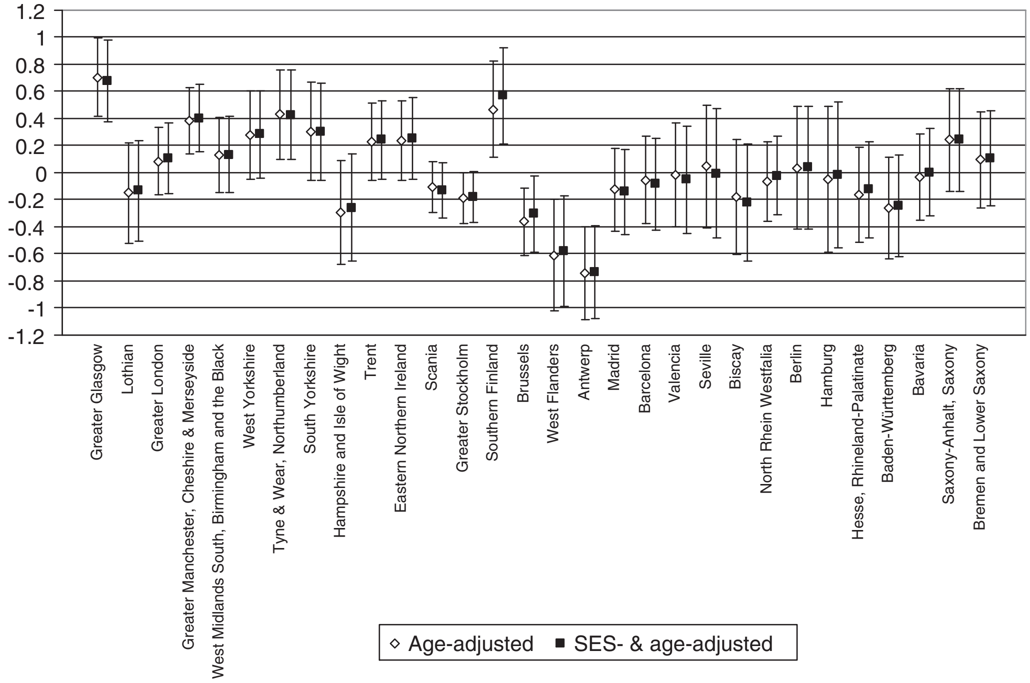
a: Social class proportions based on 2005 data only—data not available for 2001
b: Occupation data unavailable for Health Behaviour among the Finnish Adult Population Survey
c: Age given in ranges; mean age derived from age range
d: Education data unavailable for German Telephone Health Survey; Known percentage totals sum to (approximately) 100% for ease of comparison among areas

Reported acute sickness incidence (15% for men and 20% for women overall) was highest in Trent and lowest in London. Psychological distress (13% for men and 18% for women overall) was most common among men in Greater Glasgow and women in Eastern Northern Ireland, and lowest in West Flanders. Comparing sexes, bad/very bad general health and long-standing illness were generally more prevalent in men for the UK areas but more prevalent for women in Belgian and Spanish areas, whereas acute sickness and high GHQ-12 were more prevalent for women in all areas. Generally, obesity (16% for men and 15% for women overall) was more common in women for UK and Belgian areas, but more common in men for other areas.

There was generally lower prevalence of unfavourable health in the professional/managerial classes and those with degree level or above education. Socio-economic gradients within areas were generally stronger for self-rated health, longstanding illness and obesity, and weaker for psychological distress and acute sickness. With the exception of obesity, socio-economic inequalities tended to be more pronounced for areas in the UK.

Figure 1 shows the differences between each area and the average for all metropolitan areas of self-reporting of bad/very bad general health for men adjusted for age, and age, education and social class. Age-adjusted self-reporting of bad/very bad general health among men was significantly higher than average in Greater Glasgow, Manchester/Cheshire and Merseyside and Southern Finland and significantly lower than average in the areas in Belgium (figure 1). Adjusting additionally for socio-economic measures did not alter results. Among women, levels were higher in Greater Glasgow, Eastern Northern Ireland, Madrid, Barcelona and Seville, and lower in West Flanders and Antwerp; results for Madrid, Barcelona and Seville were attenuated on socio-economic adjustment.

Longstanding illness rates were significantly higher than average in men in Trent and significantly lower in the areas in Sweden and Belgium; results were not attenuated by socio-economic adjustment. Levels for women were significantly higher than average for men in Greater Glasgow and the English regions—except London and Hampshire and Isle of Wight. Significantly lower than average levels were in seen in the selected areas in Sweden and Belgium. South Yorkshire had higher than average incidence of acute sickness—the only area with levels significantly different to the male average for all areas evaluated, but this was attenuated on adjustment for socio-economic factors. Women in Scania had significantly higher levels than average which were not attenuated by socio-economic



Residual estimates give the difference between each area and the overall average (value of 0)
Adjustment by social class only for areas in Germany and education only for Southern Finland

Figure 1 Logistic regression residuals and 95% confidence intervals for self rating of bad/very bad general health for men

adjustment; women in London had significantly lower levels than average.

Obesity levels among men were significantly higher than average in Greater Glasgow, Lothian, Manchester/Cheshire and Merseyside, West Midlands South, Birmingham and the Black Country, West Yorkshire, Tyne and Wear, Northumberland, Trent, North Rhine-Westphalia, Bavaria and Saxony-Anhalt/Saxony and significantly lower than average in selected areas in Sweden and Belgium, Oslo, Barcelona, Biscay and Hamburg (figure 2). Results for Greater Glasgow, Brussels and Hamburg were attenuated on socio-economic adjustment. Among women, levels were significantly higher for Greater Glasgow, Manchester/Cheshire and Merseyside, West Midlands South, Birmingham and the Black Country, West Yorkshire, Trent, South Yorkshire and Saxony-Anhalt/Saxony and significantly lower than average in Dublin, in areas in Sweden and Belgium, Oslo, Southern Finland, Barcelona and Biscay. Analyses were performed with and without the cut-off of 29.2 kg/m^2 for self-reported measurements and overall results were the same.

Psychological distress among men was significantly higher than average in Greater Glasgow, Eastern Northern Ireland and Stockholm; West Flanders had significantly lower levels. Results were not attenuated by socio-economic adjustment; findings were similar for women with additionally lower than average levels in Scania and Antwerp.

Discussion

We found that indicators of impaired population health were generally higher than average in the metropolitan areas in the North and West of the UK and the central belt and south east of Germany, and lower in the areas in Sweden generally and those in north west Belgium included in the study, and this was generally the case in both men and women. Our findings also provide national as well as continental perspectives on the position of specific regions—e.g. Lothian and the London regions may be doing well relative to the other British areas, but badly compared with the selected continental regions overall. Others, e.g. Seville, appear unfavourable at a national level but are around the average when taken in the context of all the areas. These findings across metropolitan areas are not necessarily a direct reflection of rankings at the national level. Germany, for instance, generally has middle ranking amidst the countries for these health indicators, in contrast with that country's metropolitan areas' less favourable rankings.[10] In most cases disparities could not be explained by variations in two key indicators of individual socio-economic position.

A study comparing mortality in sub-country urban areas in Europe with histories of post industrial decline, with some overlap in Scottish, German and Belgian areas included here, found equivalently high rates in the Glasgow area compared with other regions, despite its comparatively favourable socio-economic environment.[28]

Limitations

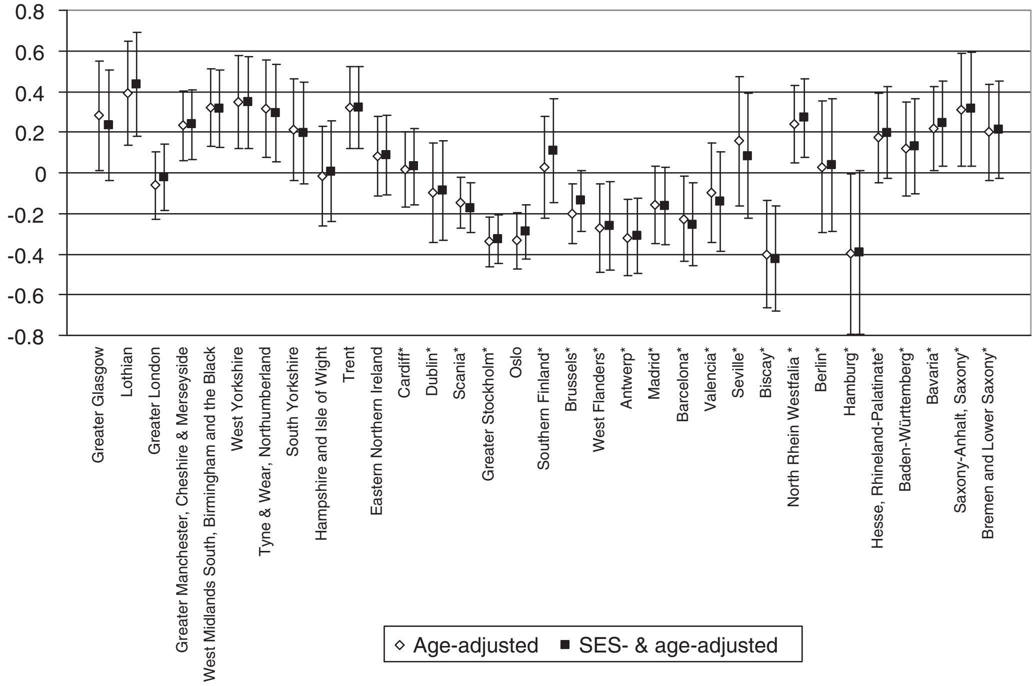
Variations in survey methodology may have impacted on findings such that within country differences are likely to be valid but between country differences may be due to measurement effects.

Survey conduct

There may be differences due to variation in language, though only items with similar phrasing were retained. Notwithstanding, there may have been mode effects, whereby differences in response arise from data collection method (e.g. telephone survey or face-to-face interview).[29] There remain issues around the validity of comparing self-reported measures of health between different countries with distinct cultures and attitudes: self reports of health are influenced not only by physical condition, but also by awareness, expectation and comparison which may be culturally determined.[30] Responses to self-assessed items were based on informants' recall and judgements and as such were subject to distortion due to variations in individual perceptions, even within areas. There are a range of choices of cut-off for self-rated health—we chose the one which reflects less than fair or average health. It is possible bias in self-reporting of anthropometry measurements, especially weight, may account for findings of lower obesity in some areas,[31] but we hope the correction factor has gone some way towards addressing this.[25]

Socio-economic measures

In using the chosen socio-economic classifications, we have attempted to create homogeneous groups; specifically, the education categorization follows closely the degree/other/none scheme, previously found to be



Residual estimates give the difference between each area and the overall average (value of 0)
Adjustment by social class only for areas in Germany and education only for Southern Finland
* Obesity status in these areas was ascertained using the lower threshold of 29.2 kg/m^2 as height and weight were self-reported (25)

Figure 2 Logistic regression residuals and 95% confidence intervals for obesity for men

consistent across countries.[32] However, it is clearly difficult to equivalize categories (e.g. we found large differences between Biscay and Dublin), therefore, arising residual confounding may reduce the validity of our findings. It is possible other material measures—such as income and economic security—could further explain the differences between regions but, since they are strongly correlated with occupation and education, we feel it unlikely their addition would yield very different results. Variations in factors operating at the regional or national levels (e.g. welfare expenditure, regeneration) may be additional sources of between-region differences but such assessment is beyond the scope of this study.

Survey response

Differences in response levels between surveys may have introduced differential selection bias, most likely resulting in underestimation of poor health in those with low response. Of the areas found to have higher levels of poor health, those in the UK have some of the highest survey response levels. If any bias was indeed active, it may result in overestimation of the differences between those and the average levels; with lower response rates, the converse would be true of the German areas. However, validation can be seen from the Welsh Health Survey, in which there was no difference in the proportion of adults reporting 'not good' general health between respondents and refusers.[33] Furthermore, response levels quoted were those for the entire surveys (in most cases it was not possible to obtain area-specific values) but there were geographical differences within at least some surveys,[34] and many of the areas potentially have lower values. Weighting schemes have been used in some surveys to address under-representation in some age, sex and socio-economic groups. However, since weighting strategies were heterogeneous it was not possible to weight in composite, and differences in underlying composition of the samples may have impacted on the results, although stratification by sex and adjustment by age and socio-economic variables should have resolved this to some extent.

Sampling

Surveys did not necessarily sample from equivalent populations, with most including only individuals living in private households—excluding those living in institutions, who were likely to be older and, on average, in poorer health[35]—while others (e.g. in Belgium) were more inclusive. For a few areas, the sample sizes were relatively small and interpretation requires caution. There can be temporal trends in health indicators—most importantly increasing obesity[36]—and surveys were not all conducted in the same year, although they did take place within a relatively short window of time. Also, differences in urban/rural characteristics of areas may be behind the observed differences but it is unlikely that they would explain all of the variation.

Conclusions

This collaboration represents the first examination of metropolitan area variations in health measures and, despite the outlined caveats, offers insight for the future monitoring of population health in Europe. We have identified limitations of the available information and the complexity of harmonizing data from different national surveys. Ideally, comparisons would be made using a standardized protocol for sampling, recruitment, data collection (including wording of the questionnaire and measurement protocols) and analysis. At present, this does not exist for nationally representative samples to allow comparison of areas within and between countries. Some multi-centre studies such as MONICA,[37] and EPIC[38] have used standardized methods but cover only small areas. Although it is mandatory for each EU member state to conduct the European Health Interview Survey (EHIS) by 2013,[39] there are difficulties with funding and planning this, particularly for countries with existing but different survey series. A European Health Examination Survey is currently being piloted, based on recommendations from the FEHES study[20] attempting to avoid the pitfalls we have identified in this study. This will enable superior comparisons to be made across Europe for public health monitoring both at national level and, where participant numbers are large enough, by population sub-groups such as demographic factors, socio-economic status, as well as region. Such surveys will allow proper monitoring of health inequalities with reliable comparability between regions and countries and, thereby, support evidence-based public health policies.

Supplementary data

Supplementary data are available at *EURPUB* online.

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Conflicts of interest: None declared.

Key points

What is already known on this subject?

- Population health varies across countries in Europe.
- The increasing concentration of populations into large metropolitan centres in recent decades has not been matched by international health assessments which hitherto largely focused on the national level.
- There is a need to compare health measures across Europe metropolitan areas and to determine the extent to which differences are due to socio-economic factors.

What does this study add?

- Findings suggest indicators of poor health are generally higher than average in the metropolitan areas in the north and west of the UK and the central belt and south east of Germany and lower in the areas in Sweden generally and north west Belgium.
- Variations between the socio-economic composition of the local area populations do not explain European metropolitan health differences.
- Further research based on internationally standardized survey data is required to explore the underlying causes of Europe metropolitan health differentials and inform health policy.

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Socio-economic status and self-rated health in East Asia: a comparison of China, Japan, South Korea and Taiwan

Tomoya Hanibuchi[1,2], Tomoki Nakaya[1], Chiyoe Murata[3]

1 Department of Geography, Ritsumeikan University, Kyoto, Japan
2 Department of Society, Human Development and Health, Harvard School of Public Health, Boston, USA
3 Department of Community Health and Preventive Medicine, Hamamatsu University School of Medicine, Hamamatsu, Japan

Correspondence: Tomoya Hanibuchi, Research Center for Disaster Mitigation of Urban Cultural Heritage, Ritsumeikan University, 58, Komatsubara Kitamachi, Kita-ku, Kyoto, Kyoto 603-8341, Japan, tel: +81 75 467 8801, fax: +81 75 467 8825, e-mail: info@hanibuchi.com

Background: Few cross-national studies have compared the relationship between socio-economic status (SES) and health among East Asian countries. This study elucidates the relationship between SES and self-rated health (SRH) in four societies of East Asia: China, Japan, South Korea and Taiwan. **Methods:** We used the data from the East Asian Social Survey 2006, which consists of nationally representative samples from each of the four countries. Logistic regression analysis of SRH was performed using four standardized SES indices (income, education, occupation and class identification) as explanatory variables to compare the degree of association of each SES index with SRH. **Results:** A total of 8120 respondents in the age range of 20–69 years were analysed. Overall, social gradients in health were observed in the East Asian societies. In China, South Korea and Taiwan, three of the four SES indices showed a statistically significant association for both male and female groups. In Japan, except class identification, no other SES index showed a significant relationship with SRH. With regard to the differences between the SES indices, class identification exhibited the strongest association with SRH, while occupational class displayed the weakest association. **Conclusion:** Our study results indicate that Japan has low levels of health inequality compared to other East Asian countries. Furthermore, an index of occupational classes may be insufficient to explain health inequalities in East Asia.

Introduction

Since publication of the 'Black Report',[1] it has been well established that a social gradient in health is a common feature of societies in Western countries.[2,3] In addition, many studies have compared among Western countries[4–8] as well as between Western and Asian countries.[9] These studies have shown that the relationship between socio-economic status (SES) and health varies in strength among countries according to the SES index that was used in the study.

However, cross-national comparative studies of East Asian countries are rare, although some have assessed SES and health in individual countries of the region.[10–15] In addition, cross-national studies that include samples from East Asia—for example, Martikainen *et al.*[9]—often do not use nationally representative samples. To our knowledge, a data set drawn from a standardized questionnaire that facilitates a cross-national comparison has so far been limited in East Asia.

Using cross-national surveys, Yamaoka[16] investigated the relationship between SES, social capital at the individual level, and health across Japan, South Korea, Singapore, five areas in mainland China and Taiwan. However, as Yamaoka's work focused mainly on general trends in the relationships between social capital and health, the differences in SES and health among East Asian countries may need further consideration. For example, the categorization criteria used for SES indices were unclear, and this makes it difficult to compare the relationships between SES and health across these countries.

Moreover, some previous studies question the interchangeability of SES indices, such as income, education and occupational class, and have shown that the association between SES and health can vary by SES indices, health outcomes and countries.[17,18] To explore which SES indices are important for health in East Asian societies, we need appropriate data and methods that allow for the comparison among countries and between SES indices.

This study uses the East Asian Social Survey (EASS) 2006 data set, a cross-national survey consisting of nationally representative samples from China, Japan, South Korea and Taiwan. We sought to compare the SES gradient in health among the four societies using the index of self-rated health (SRH) and standardized SES indices of income, education, occupation and class identification.

Methods

Data

Data used in this study are from the EASS 2006 provided by the EASS Data Archive. The archive provides data from respondents whose identities are undisclosed, for the secondary analysis of cross-national comparisons in East Asia. These data consist of a common module, set into a General Social Survey (GSS) type questionnaire, which is a nationally representative sample survey from each of the four societies. Samples were selected by multistage stratified random sampling. Respondents were surveyed from June to December 2006 by interview in China, South Korea and Taiwan and by interview and placement (self-administered) methods in Japan. Valid response rates were 38.5% in China, 59.8% in Japan, 65.7% in South Korea and 42.0% in Taiwan. Details for EASS data are described at the EASS website (http://eass.info).